CLAIMS

1. A method of detecting the presence of slag in a shroud (4) for guiding molten metal from a ladle (2) to a tundish (6), comprising:

providing a forked coil holder (10) having at least two branches;

mounting at least one transmitting coil (20) to a first branch (14) and at least one receiving coil (24) to a second branch (16) of the forked coil holder;

mounting said forked coil holder (10) to a shroud manipulator (30) adapted to manipulate the shroud;

placing the forked coil holder in such manner that an imagined straight line drawn between the transmitting coil and the receiving coil crosses the shroud;

generating, by means of said transmitting coil (20), an electromagnetic field that enters the shroud and its contents;

generating an induced voltage by means of said receiving coil (24) which is subjected to the electromagnetic field having entered the channel and its contents, wherein said induced voltage is indicative of the presence or absence of slag in said contents; and

keeping the coils (20, 24) unmovable relative to the shroud.

2. A method of detecting the presence of slag in a channel (4) for guiding molten metal, comprising:

generating, by means of at least one transmitting coil (20), an electromagnetic field that enters the channel and its contents;

generating an induced voltage by means of at least one receiving coil (24) which is subjected to the electromagnetic field having entered the channel and its contents, wherein said induced voltage is indicative of the presence or absence of slag in said contents;

characterized by generating said electromagnetic field so that it enters a shroud (4) and its contents, the shroud being said channel for guiding molten metal from a ladle (2) to a tundish (6), and by keeping the coils (20, 24) unmovable relative to the shroud.

3. The method as claimed in claim 2, further comprising:

providing said at least one transmitting coil in toroid form and arranging it so as to surround the shroud, and

providing said at least one receiving coil in toroid form and arranging it so as to surround the shroud.

4. The method as claimed in claim 2, further comprising:

providing a forked coil holder (10) having at least two branches;

mounting the transmitting coil to a first branch (14) and the receiving coil to a second branch (16) of the forked coil holder; and

placing the forked coil holder in such manner that an imagined straight line drawn between the transmitting coil and the receiving coil crosses the shroud.

5. The method as claimed in claim 4, wherein the act of placing the forked coil holder comprises mounting said forked coil holder to a shroud manipulator (30).

6. The method as claimed in claim 4, wherein the act of placing the forked coil holder comprises mounting said forked coil holder to a separate mounting device that is arranged to follow the position of the shroud.

7. The method as claimed in claim 4, wherein the act of placing the forked coil holder comprises mounting said forked coil holder to a sliding gate at the ladle.

8. The method as claimed in any one of claims 1 – 7, further comprising:

detecting turbulent flow, if any, inside the shroud; and

changing the frequency of the electromagnetic field generated by the transmitting coil in case of turbulent flow having been detected.

9. The method as claimed in any one of claims 1-8, further comprising generating, by means of said at least one transmitting coil:

an electromagnetic field of alternating frequencies, or

several electromagnetic fields with different frequencies.

10. The method as claimed in any one of claims 1-9, wherein any induced voltage having a value outside a defined voltage range is indicative of the presence of slag, the method further comprising:

determining the flow of the molten metal passing through the shroud; and

defining said voltage range depending on the magnitude of the determined flow of molten metal.

11. The method as claimed in claim 10, further comprising:

defining a larger voltage range if it is determined that the magnitude of the flow of molten metal has decreased.

12. The method as claimed in any one of claims 10 – 11, wherein the act of determining the flow of molten metal passing through the shroud comprises:

providing feedback from an opening position signal of a sliding gate at the ladle and calculating the flow

of molten metal from the sliding gate opening information.

13. The method as claimed in any one of claims 10 - 11, wherein the act of determining the flow of molten metal passing through the shroud comprises:

measuring the rate of decrease in weight of the ladle content and calculating the flow of molten metal from said measured rate of decrease in weight.

14. The method as claimed in any one of claims 10 - 11, wherein the act of determining the flow of molten metal passing through the shroud comprises:

measuring the teeming rate in the tundish and calculating the flow of molten metal from said measured teeming rate.

15. The method as claimed in any one of claims 1 - 14, further comprising:

cooling said transmitting and receiving coils.

16. A device for detecting the presence of slag in a shroud (4) for guiding molten metal from a ladle (2) to a tundish (6), comprising:

at least one transmitting coil (20) for generating an electromagnetic field to be entered into the shroud and its contents;

at least one receiving coil (24) for receiving the electromagnetic field that has entered the shroud and its contents, and for generating an induced voltage, wherein said induced voltage is indicative of the presence or absence of slag in said contents;

a shroud manipulator (30) adapted to manipulate the shroud;

characterized by a forked coil holder (10) mounted to the shroud manipulator (30) and having at least two branches, a first branch (14) carrying said at least one

transmitting coil and a second branch (16) carrying said at least one receiving coil, the two branches being placeable in such manner that the shroud is located between them and that said at least one transmitting coil and said at least one receiving coil are in a stationary position in relation to the shroud.

17. A device for detecting the presence of slag in a channel (4) for guiding molten metal, comprising:

at least one transmitting coil (20) for generating an electromagnetic field to be entered into the channel and its contents;

at least one receiving coil (24) for receiving the electromagnetic field that has entered the channel and its contents, and for generating an induced voltage, wherein said induced voltage is indicative of the presence or absence of slag in said contents;

characterized by a coil holder arrangement that is adapted to hold said at least one transmitting coil in such manner that the generated electromagnetic field enters a shroud (4) and its contents, the shroud being said channel for guiding molten metal from a ladle (2) to a tundish (6), and to hold said at least one transmitting coil and said at least one receiving coil in a stationary position in relation to the shroud.

18. The device as claimed in claim 17, wherein said coils are in the form of toroids, wherein said coil holder arrangement is adapted to hold each toroid in such manner that it surrounds the shroud.

19. A device as claimed in claim 17, wherein said coil holder arrangement comprises a forked coil holder (10) having at least two branches, a first branch (14) carrying the transmitting coil(s) and a second branch (16) carrying the receiving coil(s), the two branches

being placeable in such manner that the shroud is located between them.

20. The device as claimed in claim 19, wherein the forked coil holder is adapted to be mounted to a shroud manipulator (30).

21. The device as claimed in claim 19, wherein the forked coil holder is adapted to be mounted to a separate mounting device which is arranged to follow the position of the shroud.

22. The device as claimed in claim 19, wherein the forked coil holder is adapted to be mounted to a sliding gate at the ladle.

23. The device as claimed in any one of claims 19 - 22, wherein said two branches are electrically isolated from each other.

24. The device as claimed in any one of claims 16-23, wherein any induced voltage having a value outside a defined voltage range is indicative of the presence of slag, the device further comprising:

means for determining the flow of the molten metal passing through the shroud; and

means (52) for defining said voltage range depending on the magnitude of the measured flow.

25. The device as claimed in claim 24, wherein said means for determining the flow of the molten metal passing through the shroud comprises:

a sensor for sensing an opening position signal of a sliding gate at the ladle, and

a processor for calculating the flow of molten metal from the sliding gate opening information.

26. The device as claimed in claim 24, wherein said means for determining the flow of the molten metal passing through the shroud comprises:

a measuring device for measuring the rate of decrease in weight of the ladle content, and

a processor for calculating the flow of molten metal from said measured rate of decrease in weight.

27. The device as claimed in claim 24, wherein said means for determining the flow of the molten metal passing through the shroud comprises:

a measuring device for measuring the teeming rate in the tundish, and

a processor for calculating the flow of molten metal from said measured teeming rate.

28. The device as claimed in any one of claims 16 - 27, wherein the transmitting and receiving coils are provided with directional elements, such as a core, for directing the electromagnetic field towards and from the shroud.

29. A casting plant, comprising

a ladle (2) adapted to contain molten metal;

a tundish (6) adapted to receive molten metal from the ladle;

a shroud (4) arranged between the ladle and the tundish, wherein molten metal is enabled to pass from the ladle, through the shroud, and to the tundish; and

a device as claimed in any one of claims 16 - 28.